

## THE SOUTH AMERICAN SPECIES OF MANILKARA

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It is not intended here to review the papers already published on Manilkara, except for those on the South American species. Studies on the North American species will be mentioned briefly.

In recent times only Charles Gilly and Arthur Cronquist have been the principal students of the North American Sapotaceae. Refer to the papers by Cronquist for a clear exposition and summary.

Charles Gilly, in March, 1943, made two bold proposals regarding Manilkara. He declared Achras and Manilkara congeneric, and presented a very novel interpretation of their flower morphology. Achras and Manilkara had been widely separated by many botanists, the flowers of typical Achras and typical Manilkara being quite different, so that it took remarkable courage to expound their union. H. Pittier, in describing *Achras chicle* almost a quarter of a century previously, had noted that if the dorsal appendages of the corolla had been present the species would have been a perfect *Mimusops*, that is, Manilkara. Pierre and Urban (1904, p. 163) stated that Manilkara has the ensemble of characters of Achras, and greater resemblance to it than to *Mimusops*. Grisebach (Fl. Brit. W. Ind. 399. 1861) placed his *Sapota sideroxylon*, which is a Manilkara, in Sect. Achras next to *S. achras*; but he gave a too broad circumscription to *Sapota* (included *Micropholis*), and at the same time recognized *Mimusops*, including Manilkara, as distinct from *Sapota*. Other botanists had indirectly suggested close alliance between Achras and Manilkara, but no one before Gilly pursued the matter to a definite conclusion.

If Gilly's understanding of the flower morphology of Manilkara is proven correct, it will probably be the one most outstanding contribution to the taxonomy of the Sapotaceae. The Manilkara flower has (1) a "corolla," tubular below, segmented above, the stamens attached to the upper part of the tube opposite to the somewhat modified segments, and (2) biserrate free "sepals." In Gilly's interpretation, the "corolla" is entirely staminodial, while the inner "sepals" are petals. Obviously, such a configuration departs widely from that of a *Chrysophyllum* perianth, which consists simply of calyx and unappendaged gamopetalous corolla with epipetalous stamens opposite the corolla-lobes.

In 1943, Gilly hinted at vascularization study not fully completed to support his ingenious contention. He has not yet presented concrete evidence either from anatomy or analogy.

The species treated by Gilly in Tropical Woods for March, 1943, were only those of Achras relationship. The 12 species and 2 varieties accepted by Gilly were reduced to 4 species by Cronquist (1945), who recognized for North America but 13 species of Manilkara, including Achras, Muriea and Shaferodendron.

Regarding the South American Manilkara, Flora Brasiliensis

covered 9 species, of which 4 were fully illustrated. The studies by A. Ducke are incomparably the most important. Ducke has been the best source of original knowledge in the group. My revision has been made possible largely by Ducke's help and also by the aid received from Dr. H. N. Moldenke.

In "As Maçarandubas Amazônicas" Ducke treated 16 species. He presented descriptions, field notes and observations, and a key to the species.

Now is not the time, nor will it be for many years in the future, when studies in most groups of Sapotaceae can hope to approximate completeness. Taxonomically, the family is too much in flux. Of the many new species being discovered some fall into generic boundaries already too tenuous, thus suggesting union of genera; and still others, if in quantity, may show a sufficiently marked nuclear concentration of species to make it preferable to reinstate these genera, notwithstanding the overlapping boundaries. It is not expected that when all the taxa of Sapotaceae are known, an unbroken continuum of micro-species will reduce the family to a single genus, but certainly many genera will merge. Most recent authors separate Manilkara from Mimusops, on good grounds. Superficially there is greater difference in the flower structure of typical Achras and Manilkara than between Manilkara and Mimusops. Discovery of Mimusops in America would contribute much to its re-embracing Manilkara. A greater possibility is that intermediates may be found in the Old World, where both genera grow.

Generic revaluation may be a thing of the future, but additional knowledge to the species of Manilkara is gained almost daily. Dr. Ducke is actively continuing studies in the Brazilian Manilkara. On this very day I am in receipt of critical material obtained by Ducke. The present paper, then, should be considered an interim and provisional one, intended more to help future studies than settle many current problems.

One of the largest collections of South American Sapotaceae was made about 1940-1942 (-1946 ?) under the auspices of the Chicle Development Company. The material of Manilkara collected on this project has been removed from The New York Botanical Garden to an undesignated place and is not available for study. Specimens in this collection were named in the herbarium as new species by Gilly. Most of these and other cheironyms remain unpublished.

Mimusops reticulata Huber ex Ducke, Bol. Mus. Goeldi (1913) 7:174 is a nomen nudum. In a discussion of the flora of the municipality of Obidos, Pará, Brazil, Ducke wrote that this shrub (with fruits very sweet and tasty) is perhaps the most common and certainly the most characteristic there, not encountered elsewhere. This invalid name has not been identified.

Manilkara is a member of the Mimusoepae. See Dubard for a world synopsis of the group and good schematic illustrations of the flowers. The genera of this tribe by far the best represented are Manilkara and Mimusops. While Mimusops is confined to the Old World, Manilkara is found in about equal ratios in both hemispheres. In America it is found in Florida and the West Indies to extratropical South America. Achras, wholly American, is confined to the northern part of the range; this

alone might suggest a distinct generic status for *Achras*, albeit a weak one. There is, no doubt, transition between *Achras* and *Manilkara*, but transition alone does not always justify synonymy. If it did, it would be necessary to unite families, genera and species of plants by the scores.

Elbert L. Little, Jr. (*Rhodora* 49:289-293. 1947; Ballots for Proposed Amendments to the International Rules of Botanical Nomenclature etc., 6361. 1948) proposed *Achras* L. emend. Loefl. ex L. for conservation against *Manilkara*, if necessary. The following arguments might be presented against his proposal. All species of *Achras* have already been transferred to *Manilkara*; there are some 50 names in the latter still not appended to *Achras*. There is little likelihood that many new species of *Achras* will be described. On the contrary, novelties in *Manilkara* will continue to be published even if *Achras* is conserved, as some botanists will not agree to their equivalency. Others, confirmed believers in the synonymous link of the two, will snatch the new names for transfer. The recombination will be done automatically by some, without profound consideration of the botany of *Achras* and its position in the *Mimosopeae* as a whole. In addition to the early confusion regarding *Achras*, approximately 20 names already published in this genus belong to species of *Calocarpum*, *Pouteria*, *Dipholis*, *Bumelia*, etc. Although "*Achras zapota*" is more familiar in texts and to commercial persons, it is botanically less precise than *Manilkara zapotilla*; real taxonomic contributions to the *Achras* complex have been made only comparatively recently by Pittier, Gilly, Cronquist, and others.

Dr. Little suggested that *Achras zapota* L. (1753) be considered emended, and argued for its retention under Article 50 of the International Rules, which states that an alteration of the diagnostic characters of a group does not warrant a change in name. The original description of *Achras* L. (*Gen. Pl.*, ed. 5) was based completely on "*Sapota* Plum. 4." Plumier's figure and Linnaeus' description contain no recognizable element of *Manilkara zapotilla*. In *Species Plantarum*, Linnaeus presents seven citations under *Achras zapota*, not one of which, apparently, refers to *M. zapotilla*. In fact, two citations (*Sloan. jam.* and *Pluk. alm.*) rather definitely suggest *Calocarpum sapota* (= *C. mammosum*). Article 50 is not definite on the subject, but it seems that it intended no extension of the meaning of "alteration" to include complete change, a wholly new definition of a group containing not one of the original elements.

Up to at least 1950, Ducke was not fully convinced of a distinct generic separation of *Manilkara* from *Mimosops*. However, in "*As Maçarandubas Amazônicas*" he used *Manilkara* in designating the species. Previously, he published new species under *Mimosops*, and later, in 1942, he proposed *M. longiciliata* and *M. siqueiraei* under both genera simultaneously, e.g., "*Manilkara longiciliata* Ducke, sp. nov. vel *Mimosops longiciliata* Ducke, sp. nov." This form of publication has been regarded as invalid under Article 37 of the International Rules, because the names were "proposed provisionally in anticipation of the eventual acceptance" of one or the other; because neither one was "definitely accepted by the author."

I do not regard Ducke's usage a serious breach of the Rules.

It may truly be that Ducke proposed the alternate name in anticipation of its possible eventual acceptance, but one can assume otherwise, that Ducke definitely, not provisionally, accepted both binomials, as both were and would be equally worthy of acceptance. Under some circumstances the species is better referred to *Mimusops* and in other instances to *Manilkara*, the preference being sometimes reversed for the sake of convenience, not for botanical reasons. There is nothing in Ducke's usage to preclude "definite acceptance" of both names. Or, to use a different argument, Ducke's "vel" may be interpreted as "indication of taxonomic doubt," which, according to the changes made at the 7th Int. Cong. at Stockholm, does not apply to the provision concerning definite acceptance. In the present stage of knowledge of generic delimitations in the Sapotaceae, certain species fall into two genera with almost equally good reasons. Publication of alternate names simultaneously by the same author, in such instances, is more commendable than publication of new combinations at different times by the same or different authors.

In respect to separation of *Mimusops* and *Manilkara* see Dubard (1915), Eyma (1936), Lam (1941), Cronquist (1946), and Ducke (1950). Pierre and Urban suggested in 1904 that *Manilkara* is a distinct genus.

*Manilkara* falls in *Mimusops* sect. *Ternaria* A.DC. (1844), and *Mimusops* subgen. *Manilkara* (Adanson) Pierre & Urban (1904). *Manilkara* sect. *Eumanilkara* Dubard (1915) was elevated to a subgenus by Gilly (1943). *M. zapotilla* was placed in *Sapota* sect. *Achras* A.DC. in *Prodrömus*. The *Achras* group was trisected by Gilly into subgenera *Manilkariopsis*, *Nispero* and *Euachras*. Some species have the filaments and staminodes united below into a very short tube (*Synarrhena* Fisch. & Mey., 1841). The indumentum is an important diagnostic character but is quickly lost. Its base color is rusty or rufous becoming greyish with age. The leaf-blades are oblanceolate or obovate to subelliptic; more or less cuneate at the base; rounded or emarginate to slightly narrowed or short-acuminate at the apex; the midrib is usually raised on the upperside. The pedicels elongate in fruit, sometimes greatly. The sepals are variously pubescent outside and often are hairy also along the margins within; the inner sepals are slightly different from the outer in shape (more oblong), texture (thinner), and have lighter colored indumentum. The corolla-tube in most species of *Eumanilkara* is approximately one mm. long; the lobes are narrowed at base into somewhat of a claw. The staminodes are, within certain limits, highly variable in size, shape and lobing, and unless broadly interpreted may lead to error. For an example of variation in sapotaceous staminodes see Lam (1925), *Planchonella obovata*, fig. 58. Flower size is also variable; the measurements given in the following descriptions of species are all approximate. *Manilkara bidentata*, and perhaps some other species, comprise numerous forms, and may prove to be "species complexes." Many indubiously distinct taxa are closely allied and difficult to distinguish in the herbarium. *M. subsericea* of South America and *M. angolensis* of Africa present an instance of two species that simulate each other.



In the northern range of our area there are three species belonging to the section *Achras*. These extend to North America and are treated by Cronquist (1945). Their relationship to other North American species has not been studied by me.

In South America the species are found in the eastern part of the continent. The center of concentration of *Eumanilkara* is in the hylaea of the Amazon.

Species of *Manilkara* and *Mimusops* have been cultivated in the New World since early times. Aublet's *Achras balata* in 1775 was based on an introduced species, *Mimusops commersonii*, found in botanic gardens in the Antilles, Guiana and Brazil (Chevalier). The type-species of *Manilkara*, the Asiatic *M. kauki*, was introduced in Jamaica and Guiana; naturalized in Saint Vincent (Grisebach, Fl. Br. W. Ind., p. 400. 1861). *Mimusops elengi* has been introduced in the West Indies; its cultivation in Brazil is mentioned by Martius (Flora 22 Beibl. 4. 1839) and Barbosa Rodrigues. It was collected in the Trinidad Botanical Garden (Rusby, Apr. 1836) and in the wild land in the Botanic Garden, Georgetown, British Guiana (A.S.Hitchcock 16545, low ground of Jungle, Oct. 1919). *M. zapotilla* may be found anywhere in the tropics. Campos Porto lists the following species cultivated in the Jardim Botânico do Rio de Janeiro: *M. bidentata*, from Rio Branco, *M. huberi* and *M. amazonica* from Belém do Pará. In addition to the species already mentioned, the U. S. Dept. Agr., Bureau of Plant Industry, lists receipt of seeds of *Mimusops zeyheri* (1920 and 1925).

#### ARTIFICIAL KEY TO SOUTH AMERICAN SPECIES OF MANILKARA

1. Appendages of corolla-lobes free to summit of tube, flowers usually several to many in the axil, sepals less than 7 mm. long (except *M. longifolia*), corolla-tube less than 2 mm. long, staminodes less than 2.5 mm. long (excluding long filamentous tips in some), ovary glabrous (except *M. elata*, *M. excelsa*, *M. pubicarpa*). (*Eumanilkara*).....2.
2. Leaf blades at maturity densely appressed-pubescent beneath (see also *M. bidentata*, *M. longiciliata*).....3.
3. Pedicels shorter than or little surpassing subtending petiole.....4.
4. Reticulation of veinlets very striking on underside of leaves, indumentum chiefly ochre-yellow, covered by a vernicose coating, blades large, 7.5 - 27 cm. long, ovary pubescent...1. *M. elata*
4. Reticulation not striking.....5.
5. Blades moderate-sized or small, 4 - 15 cm. long, pubescence beneath of linear trichomes, staminodes over 1.5 mm. long, deeply cut.....6.
6. Calyx less than 3 mm. diam., closely appressed scurfy-pubescent; Pará, Maranhão.....2. *M. paraensis*

6. Calyx over 3 mm. diam., tomentose with subspreading hairs, lateral nerves on underside of blades slightly elevated.....7.
7. Leaf-blades obovate, broadly cuneate at base, staminodes sharply bifid, 0.5 mm. broad, young leaves densely rufous-tomentose as well as strigulose; Ceará-Bahia.....3. M. duckei
7. Leaf-blades oblanceolate, gradually tapering at base, staminodes irregularly multifid, 0.8 - 1 mm. broad, young leaves stigulose only; Rio de Janeiro, Espirito Santo.....4. M. bella
5. Blades very large, 15 - 26 cm. long, minutely squamulose-vernigose beneath, staminodes very short, 0.7 mm. long.....19. M. sp.
3. Pedicels clearly longer than subtending petiole, indumentum on underside of leaf an evanescent argenteous peltate, staminodes 1.7 - 2.6 mm. long, irregularly laciniate.....5. M. subsericea
2. Leaf-blades at maturity glabrous or sparsely pubescent.....8.
8. Pedicels clearly longer than subtending petiole; Pará-south.....9.
9. Innovations and young leaves glabrous or appressed puberulent.....10.
10. Fascicles many flowered (3-numerous), staminodes 1.5 mm. or longer, deeply cut. (Glabrous form of M. subsericea ?).....6. M. floribunda
10. Fascicles few flowered (3 - 1, rarely more), staminodes 0.3 - 0.9 mm. long, entire or lightly denticulate, corolla-lobes pubescent...9. M. triflora
9. Innovations and young leaves densely rufous fuzzy-tomentose, lateral nerves on underside of blades not elevated.....11.
11. Underside of older leaves with some appressed hairs persisting..10. M. rufula
11. Underside of leaves quickly becoming completely glabrous.....11. M. dardanoi
8. Pedicels shorter than or about equal to subtending petiole, staminodes over 1 mm. long; chiefly Pará - north.....12.
12. Ovary pubescent, staminodes normally without filamentous elongations.....13.
13. Innovations, young leaves and sepals rufous-tomentose, hairs spreading; Pará.....12. M. excelsa

13. Innovations, young leaves and sepals puberulent, hairs appressed; British Guiana.....13. M. pubicarpa
12. Ovary glabrous, indumentum on leaves appressed.....14.
14. Lacinae of staminodes with thread-like extensions.....15.
15. Leaf-blades thick, obovate, broad, 4.5 - 8 cm. broad, underside appearing glabrous but perhaps appressed furfuraceous overlaid with resin...14. M. longiciliata
15. Leaf-blades thin, oblanceolate to elliptic-oblong, narrow, 2.5 - 5 cm. broad, glabrous; wide distribution.....15. M. imundata
14. Lacinae of staminodes without thread-like elongations.....16.
16. Sepals less than 6 mm. long.....17.
17. Outer sepals sparsely minutely appressed squamulose, pedicels glabrous, reticulation on underside of leaves minutely prominent under a lens.....16. M. surinamensis
17. Outer sepals densely tomentulose, pedicels tomentulose on upper part.....18.
18. Lateral nerves slightly raised on underside of leaves.....19.
19. Blades not conspicuously cuneate, oblanceolate to subelliptic; wide distribution.....17. M. bidentata  
(M. siqueiraei)
19. Blades very conspicuously cuneate at base, obovate; Venezuela.....18. M. williamsii
18. Lateral nerves not elevated; southern Brazil.....7. M. salzmanni
16. Sepals 10 mm. long, leaves 13 - 34 cm. long; southern Brazil.....8. M. longifolia
1. Appendages united to corolla-lobes or apparently absent, sepals 7 - 9 mm. long, corolla-tube over 2 mm. long, staminodes petaloid, over 2.5 mm. long, ovary pubescent, pedicels about equal to length of petiole, leaves chartaceous to subcoriaceous; northern Colombia and Venezuela. (Achras or Euachras).....20.
20. Flowers 2 - 5 in the axil, corolla-tube 2 - 2.4 mm. long, leaves subvernicate beneath, appressed scurfy-pubescent when young, corolla-lobes unappendaged.....20. M. calcicola
20. Flowers 1 in the axil, corolla-tube 4 - 5 mm. long, leaves rufous-tomentose when young.....21.

21. Corolla-lobes and appendages free  
 1/3 - 2/3 their length.....21. M. meridionalis  
 21. Corolla-lobes entire or denticulate  
 at apex.....22. M. zapotilla

1. MANILKARA ELATA (Fr. Allem. ex Miq.) Monachino, comb. nov.  
Mimusops ? elata Allem. ex Miq., in Mart. Fl. Bras. 7:42.  
 1863. Non M. elata Allemão, 1866.  
Mimusops Huberi Ducke, Arch. Jard. Bot. Rio de Janeiro  
 2:14. 1918.

Manilkara Huberi A. Chev., Rev. Bot. Appl. & Agr. Trop.  
 12:276, 351. 1932; Standl., Trop. Woods 33:19. 1933.

Tree 30 - 40 m. or up to 50 m., petioles 2.5 - 5 cm. long, blades elliptic to suboblanceolate, 7.5 - 27 cm. long, (2.5-)5 - 12 cm. broad, underside densely covered with yellow-brown, ochre-yellow or paler, appressed tomentum overlaid by a transparent waxy coat, delicately striolate with many lateral nerves, the reticulation forming a characteristic fine network of usually brown veinlets contrasted against a lighter background. Pedicels 1.5 - 2.3(-3) cm. long, tomentulose-scurfy, sepals 4.3 - 5 mm. long, corolla-segments 3 - 3.3 mm. long, staminodes 1.8 mm. long, 0.8 - 0.9 mm. broad, sharply bifid, filaments 2 mm. long, anthers 1.3 mm. long, ovary appressed-tomentulose.

Type.- Erroneous locality given in the original description: "silvas prov. Sebastianopolitanae et Bahiensis: M." Data on photo of Martius plant at Herb. Regium Monacense: "silvas prov. Bahiensis, etc. e.g. ad Ferradas. Martius 1819 ?" In 1819, Martius traveled in both Pará and Bahia (Fl. Bras. 1:60). Type of M. huberi: "silvis primaevis haud vel rarius inundatis civitatis Pará; ad viam ferream inter Belém et Brangança prope Castanhal (Herb. Amaz. Mus. Paraensis 3.279) et prope Santa Izabel (10.177); ad flumen Guamá prope Ourem (4.067); in regione fluvii Trombetas inter flumina Cumina-mirim et Ariramba (7.976, 11.460, 11.910, 14.965)."

Illust.- (M. huberi).- Ducke (1918, p. 14, fl. analysis; pl. 2A, photo fl. br. Also 1922, p. 239, b, as "M. rufula" by error).

Distrib.- "Upland rain forest through Pará, up to eastern half of Amazonas and northern Matto Grosso; Dutch and British Guiana, and Venezuela" (Ducke 1942). A. J. Sampaio told Chevalier verbally that M. huberi is a good producer of balata, and that in the Obidões-Tumuc-Humac region (expedition Rondon) it is the most frequent and tallest tree, as abundant in the forest area of the river as on the chain of Tumuc-Humac Mts.

This species was called Mimusops elata by Huber. Ducke, apparently giving weight to locality cited and credit given to Allemão in Flora Brasiliensis, judged the Allemão collection from Ceará (M. bella Monachino) typified M. elata. He identified the Pará material as M. huberi, a view that has been followed by Eyma and others.

I base my rather novel concept on study of the type. A small leaf segment of M. huberi, Ducke 140, Parintins, Lago Uaicurapá, was sent to Dr. K. Suessenguth to compare with the type of M. elata at Munich. Professor Suessenguth (letter of



Nov. 2, 1951) wrote:

"We have compared the fragment of Mimusops huberi sent by you with our type of M. elata. An exact identification, naturally, is not possible with respect to the small material. The network, in the whole, is just the same; probably in M. elata, the anastomoses are a little more distinct. M. huberi possesses a tomentum consisting of minute needle-shaped yellowish brown hairs enclosed in a dense cover of wax. Just the same cover is found in M. elata, but the hairs are more hyaline and therefore the undersurface of leaves seems to be glabrous. We cannot decide how far that difference of colour is of systematical importance. We return the fragment of M. huberi and add such one of M. elata's type. If it seems necessary, you can get that type on loan, too."

The leaf segment of the type sent by Suessenguth is approximately 21 x 17 mm. It is indistinguishable from M. huberi. The greyish color phase of the indumentum in M. elata type is frequently found in M. huberi (e.g., C. Wilgreß Anderson 9, British Guiana). The photo of the Martius type (Field Mus. and Gray Herb.) shows the characteristic reticulation of veinlets.

The original description in Fl. Bras. (leaves "multinerviostriulatis...venulis distinctis" etc.) agrees with the Martius type at Munich. It was based on sterile material. An oversized juvenile leaf of M. bella (M. elata sensu Ducke) sent to me by Ducke bore no resemblance to M. huberi (true M. elata). Ducke, who knows both M. huberi and M. bella in the field, stressed that the leaves of the two are always and unmistakably distinguishable from each other.

There is no other known South American species with leaves resembling those of M. elata. If there were any southern Brazil species with such characteristic leaves, it would probably have commanded attention by now.

The leaf character of M. elata, however, can be duplicated in other species. Manilkara excisa (Urban) Gilly ex Cronquist, of Jamaica in the West Indies, has leaf indumentum and venation remarkably like in M. elata, although the flowers of the two species are very different. I choose to believe that actually the type of M. elata was collected in Northern Brazil, rather than assume that a species with leaves like it remains undiscovered in Southern Brazil.

To select the Allemão collection as the type would be in disregard of the indubious Martius type at Munich and the original description which agrees in all particulars with the Martius type. Allemão's M. elata may be regarded as a later homonym. His description should not be interpreted as an emendation of Miquel's species. "Mimusops elata Fr. Allemão in litt. ad Martium" was cited by Miquel probably due to some misinterpretation; in any event, the citation is ambiguous. Allemão noted regarding his Massaranduba that it was found in all the forests of Brazil from Pará to Santa Catharina.

Ducke (1950, p. 233) refers to "Manilkara elata (Fr. All.) Chev." The combination was not located in works by Chevalier. It was not formally proposed by Ducke.

M. elata is the true Massaranduba of Pará. The wood is

said to be excellent and used for civil and naval construction (Pará: R.C. Monteiro da Costa 319, Capucho 367).

Acknowledgment is made to Prof. Dr. K. Suessenguth, to whom we owe the clarification of M. elata.

2. MANILKARA PARAENSIS (Huber) Standl., Trop. Woods 34:41. 1933  
Mimusops paraensis Huber, Bol. Mus. Goeldi 4:435. 1904.  
M. paraensis var. discolor Huber, and var. densiflora Huber,  
 loc. cit.

Petioles 1 - 1.5 cm. long, blades small, 4.5 - 10(-14) cm. long, 1.5 - 3(-5) cm. broad, rounded to little narrowed or short-acuminate at apex, tapering at base, dull above, under-side yellow or greyish ferrugineous with dense closely appressed scurfy indumentum, lateral nerves hardly raised below, reticulation obscure. Pedicels 8 - 10 mm. long, scurfy, sepals 3.3 - 4 mm. long, corolla-segments 3.3 mm. long, staminodes 3 mm. long, deeply bifid, laciniae very slender, filaments 2.2 mm. long, anthers 1.5 mm. long, ovary glabrous.

Type.- Huber cited "Furo do Arrozal" for var. densiflora (first var.) and "diversos exemplares da estrada de ferro de Bragança et do rio Capim" for var. discolor; he did not indicate the typical variety. Ducke (1950, p. 242) cited "rio Capim, tipo da espécie, Huber, Herb. Mus. Pará 855 b; arrozal, perto de Belém, Herb. Mus. Pará 4.015 (tipo da var. discolor Hub.)." Fragment of 4015, photo and fragment of Aliverto 3280 (Castanhal, Belém-Bragança, 1903) at N.Y.B.G.

Distrib.- Pará, northeastern Maranhão; swampy forests.

The seeds of Mimusops maparajuba Huber belong to M. paraensis, according to Ducke (1950, p. 236).

Ducke (1922, p. 238) refers to the two varieties as forms and states that they are found on the same individual. In Tropical Woods, he (1942, p. 22) cited "Manilkara paraensis (Huber) Chev."; I was unable to find this combination in publications by Chevalier.

3. MANILKARA DUCKEI Monachino, sp. nov.

Arbor, petiolis 1 - 2 cm. longis, laminis obovatis usque ad oblongo-obovatis ca. 5 - 9 cm. longis, 3 - 5 cm. latis, ad basin cuneatis, ad apicem emarginatis vel obtusis, in statu juvenili subtus atrorufotomentosis, postquam rufo-sericeis denique parce griseo-sericeis, costa supra impressa; pedicellis ca. 1 cm. longis rufo-tomentosis; appendicibus loborum corollas ca. 2 mm. longis ad apicem obscure denticulatis; staminodeis ca. 1.5 - 2 mm. longis, 0.5 mm. latis, argute bifidis.

Type.- Dárdano de A. Lima 49-168, Serra Negra, 8-2-1949, deposited at The New York Botanical Garden. Other specimens examined: Ducke 1428, Ceará (leaves and flower fragments); Ducke 2028, Ceará, parte occidentale do planalto da Serra de Baturité (leaves); R.deLemos Fróes 20091, Bahia, Ibyquara, região da Sincorá, Feb. 24, 1943, árvore, 10 m., sem látex, frutos amarelos (leafy branch with young fruits).

This species is the "M. rufula" in the sense of Ducke (1918, p. 15. 1950, p. 234, 242). Ducke informs me that a collection by F. Allemão from Ceará, labelled M. elata, is this plant. M. elata of Allemão (1866, p. 45) is in part this plant (Ducke, 1918, p. 15).

Illust.- Ducke (1918, p. 13, under M. elata; 1922, p. 239, a, under M. huberi. Flower analysis).

Distrib.- Ceará, Pernambuco, Bahia.

Closely allied to M. bella. Differs in leaf-shape, indumentum and staminodial lobing. See distinctions given by Ducke in works cited above. The long petioles, the elevated lateral nerves and minutely prominulous reticulation on the underside of the leaves readily separate it from true M. rufula; the close appressed indumentum is much more persistent and of longer hairs than in M. rufula.

#### 4. MANILKARA BELLA Monachino, sp. nov.

Arbor, foliis versus apicem ramorum confertis, petiolis 1 - 3.5 cm. longis, laminis oblanceolatis usque ad basin gradatim angustatis 6 - 13.5(-17) cm. longis, 2 - 5 cm. latis, subtus sericeis, costa supra elevata. Pedicellis ca. 1.5 cm. longis fulvo-tomentosis; appendicibus loborum corollae ad apicem valde denticulatis; staminodeis ca. 2 mm. longis, 0.8 - 1 mm. latis, irregulariter multifidis.

Type.- Glaziou Herb. 12071, Rio de Janeiro, 1880, deposited at The New York Botanical Garden.

It is "M. elata" in the sense of Ducke (1918, p. 13, etc.). Ducke (letter of Dec. 6, 1951) wrote that a specimen of F. Allemão, named M. elata, is preserved at the Jardim Botânico of Rio and that Glaziou 12071, which he saw in the Museu Nacional, is certainly conspecific. Ducke (1918, p. 15) noted that M. elata of Allemão in Trabalhos da Comm. Scient., 1866, is M. rufula Miq., exclusive of the description of the leaves and illustration of the fruiting branch. A photo (Field Mus., Gray Herb.) of Allemão's floriferous collection at Paris resembles our plant; no collection data appeared on the photo.

Illust.- Ducke (1918, p. 15, fl. analysis, as M. rufula. 1922, p. 239, c, same, as M. elata). Allemão (1866, t. 2, see remarks above). Saldanha da Gama (1872, t. 5, same as previous). Pinto's "Mimusops excelsa Allem." (Diccion. Bot. Brasil, fig. 24. 1873) probably refers to the present species.

Dist.- Rio de Janeiro and Espirito Santo (Ducke, 1950. p. 233). In his letter to me (Jan. 1, 1952), Ducke wrote that it grows in the sub-tropical forests of Rio, from 600 to 700 m. upwards.

Ducke (1918, p. 13) makes reference to juvenile leaves of this species. Through the kindness of Dr. Brade he sent me one young leaf and part of another of Ducke 17625, Serra de Friburgo, Estado do Rio de Janeiro, July 1915. Petiole 2 - 3 cm. long, blade 15 cm. long, 5.9 - 6.5 cm. broad, oblanceolate, acuminate at base, appressed hairs beneath greyish or pale brown, midrib raised above, lateral nerves little if at all raised below, reticulation of veinlets not manifest below.

The leaves of M. bella, both in the adult and juvenile state, are altogether different from those of the type of M. elata (a fragment sent to me by K. Suessenguth of Munich). The leaves of M. elata type are like those of M. huberi. The leaf venation of M. huberi and M. bella ("M. elata" of Ducke) is constantly and entirely different (Ducke, letter of Dec. 6, 1951). M. bella is closest related with M. duckei.

The specific epithet is an herbarium name used by Gilly.

5. MANILKARA SUBSERICEA (Mart.) Dubard, Ann. Mus. Col. Mar-seille, ser. 3, 3:22. 1915.

Mimusops subsericea Mart., Flora, 22, Beiblatt 1:3. 1839.

Synarrhena subsericea Fisch. & Mey., Bull. Sc. Acad.

Petersb. 8:255. 1841.

Mimusops subsericea var. acmanthera Miq., in Mart. Fl. Bras. 7:43 bis. 1863.

Small tree, petioles 3 - 10(-16) mm. long, blades (3-)4 - 10(-13) cm. long, 2-4(-6.5) cm. broad, underside with a metallic silky-argenteous (or faintly amber) pellicule consisting of closely appressed flattened hairs, this thin indumentum mostly deciduous, remaining in protected places or in patches on some leaves, lateral nerves very slightly raised on the underside. Pedicels longer than subtending petiole, 0.7 - 1.5 cm. long, sparsely appressed strigulose-puberulent on upper part, sepals 3.3 - 5 mm. long, the indumentum of the outer sepals comparatively greyish, corolla-tube 0.5 - 1.3 mm. long, segments 2.7 - 2.8 mm. long, staminodes 1.7 - 2.6 mm. long, irregularly laciniate, base of staminodes and filaments united into a short tube up to 1 mm. high, filaments 1.5 - 2 mm. long, anthers 1.8 mm. long, ovary glabrous, cells six.

Type.- "Montis Corcovado sylvis et alibi in Prov. Sebastianopolitana...Mart. infra. No. 487." Isotype at N.Y.B.G. Type of var. acmanthera: "Brasilia orientali: Sellow."

Illust.- Miquel (1856, t. 16).

Distrib.- Rio de Janeiro, Bahia. "Morros e restingas do Rio de Janeiro e litoral de São Paulo" (Ducke 1950, p. 234).

Fischer and Meyer (1841, p. 255) presented an elaborate description of M. subsericea, of which they saw a cultivated plant, as well as dried specimens. They wrote that the species bloomed for the first time in 1840 in the botanic garden. The flowers had the odor of Pittosporum tobira, ochroleucus corolla with cuculate lobes enfolding the anthers. This species and M. floribunda are cited by Fischer and Meyer for their new genus Synarrhena.

Raunkiaer (1890, p. 2) refers to a variety with apices of the staminodes profoundly 4 - 6-fid.

M. subsericea resembles the African M. angolensis (Engl.) Lecomte ex Pellegr.

Two sterile branches on a sheet in the Torrey Herbarium (N.Y.B.G.) labelled "Bumelia retusa. Secund Spreng. West Indies. M. Perrin" suggest Manilkara angolensis. Reasons for believing that Perrin collected in Africa are presented in Lloydia (1945) 8:313.

The title page of The N. Y. Bot. Gd. copy of Martius' Herbarium Florae Brasiliensis bears the year of publication 1837. However, M. floribunda, appearing on page 179, was published at a later date. On p. 168 of this book reference is made to Eupatorium martiusii DC. Prodr. 7:269, which was published in 1838; this page therefore appeared in print 1838 or later.

6. MANILKARA FLORIBUNDA (Mart.) Dubard, Ann. Mus. Col. Mar-seille, ser. 3, 3:22. 1915.

Mimusops floribunda Mart., Flora, Beiblatt 1:3. 1839.

Synarrhena floribunda Fisch. & Mey., Bull. Sc. Acad. Petersb. 8:256. 1841.

Petioles short, 3 - 6 mm. long, blades elliptic or obovate-



elliptic, 3.5 - 6.5 cm. long, 2 - 3 cm. broad, glabrous or when young thinly and sparsely sericeous appressed lepidote, nerves distinct beneath; pedicels surpassing petiole, staminodes and filaments about equal length, briefly connate at base, ovary 6-celled. (Compiled from description, illustration and photo of type.)

Type.- "Crecit arenosis, ad Oceani littus, e.g. prope Cabo frio," Rio de Janeiro, Herb. Mart. 488. (Type photo at Field Mus., Gray Herb.)

Illust.- Miquel (1856, t. 17).

Martius observed that this species is perhaps a variety of M. subsericea. Ducke (1950, p. 236, 244) stated that it is with great probability a glabrous leaved M. subsericea. At Rio he saw material, from the maritime restingas near the city, with subglabrous leaves forming transitions to the common form with leaves sericeous beneath.

7. MANILKARA SALZMANNI (A.DC.) H. J. Lam, Blumea 4:356. 1941. Mimusops Salzmanni A.DC., Prodr. 8:205. 1844.

M. Salzmanni β. mucronata A.DC., loc. cit.

Petioles 1.2 - 2.5 cm. long, blades coriaceous, 9.5 - 13 cm. long, 4 - 5.7 cm. broad, glabrous, when young with sparse scattered appressed hairs, lateral nerves not raised beneath, reticulation sometimes impressed. Pedicels deflexed, 1 cm. long, sparsely hairy, sepals 4 - 4.3 mm. long, rufous-tomentose, corolla-segments 3 - 3.3 mm. long, staminodes shorter or longer than filaments, 1.7 - 2.2 mm. long, 2 - 3 lacinate to 0.8 mm., filaments 1.7 - 2.5 mm. long, anthers 1.5 mm. long, ovary glabrous.

Type.- "prope Bahiam in sabulosis maritimus (Salzm. ! Blanch. ! coll. lign. n. 218)." Photo of the Geneva specimen of Salzmann 7503 at Field Mus. Type of β. mucronata: "prov. Bahiensi (Blanch. ! n. 3171)." Isotype of β. mucronata at Field Mus. ("Bahia, partie méridionale").

Distrib.- Pernambuco, Bahia and Espirito Santo (Ducke 1950, p. 236, 238, 239). Riedel 401 is from Rio de Janeiro, "silv. maritimas pr. Ilheos, Sept. 1826."

Riedel 401 has petioles up to 2.5 cm. long, blades up to 13 cm. long, 6 cm. broad; staminodes longer than the filaments, almost reaching height of anthers, Lima 49-366, from Dois Irmãos, has short petioles, 5 - 9 mm. long, blades 4 - 6 cm. long, 1.6 - 2.4 cm. broad, midrib raised on upperside; pedicel longer than petiole, staminodes and filaments free, ovary 10-celled. Another collection from Recife (Lima 49-315) has leaves up to 9 cm. long and 4.5 cm. broad. Froes 20035 and 20071, from Bahia, have relatively short petioles, 8 - 12 mm. long (sterile branches, leaves near ends of twigs); midrib raised on upper side of blade. The midrib in Blanchet 3171 is slightly or not raised on the leaf upperside; staminodes and filaments are united at base for a short distance to varying degrees. Ducke states that trees from Mata dos Morros de Dois Irmãos, in the suburbs of Recife, are taller and have smaller, narrower leaves than those of the littoral.

According to Ducke (1950, p. 244), Glaziou 11158, syntype of M. glaziovii, belongs here; M. salzmanni is cultivated in Quinta de S. Cristovão, Rio de Janeiro.



I am doubtful how to interpret the leaf varieties in M. salzmanni, length of petioles, size of blades, and depressed or elevated midrib on the leaf upperside. It is not impossible that some of the material belongs to M. floribunda and the two species intergrade.

8. MANILKARA LONGIFOLIA (A.DC.) Dubard, Ann. Mus. Col. Marseille, ser. 3, 3:22. 1915.

Mimusops longifolia A.DC., Prodr. 8:205. 1844.

Branchlets robust, petioles 2.5 - 6 cm. long, blades coriaceous, large, 18 - 34 cm. long, 5 - 6.5 cm. broad, glabrous except for loose evanescent tomentum on midrib of underside, lateral nerves depressed, reticulation depressed. Pedicels 4 cm. long, rufous tomentose with spreading hairs, flowers large, calyx 8 mm. across, sepals 10 mm. long, corolla-tube 1.6 - 1.7 mm. long, segments 5.5 - 6.7 mm. long, irregularly dentate-erose, staminodes broad, 1.6 mm. broad, 2 mm. long, bifid, lacinae 0.8 mm. long, deeply cut, filaments 3.3 mm. long, anthers 2.7 mm. long, ovary glabrous.

Type.- "circa Bahiam (Blanch. ! n. 3172). v. in h. Boiss." "Partie meridionale...1840" (photo of Geneva specimen of Blanchet 3172A, Field Mus.). Isotypes at Field Mus. and Gray Herb.

Illust.- Miquel (1856, t. 15).

Distrib.- "sul da Bahia e norte do Espirito Santo" (Ducke, 1950, p. 33).

H.M. Curran 102 (U.S.N.H., det. doubtful), from Rio Grongogy, is a stump sprout; stem slender, pubescent toward apex, petioles less than 1.5 cm. long, blades with acumen 1 cm. long, glabrous, veins on underside raised.

9. MANILKARA TRIFLORA (Fr. Allem.) Monachino, comb. nov.

Mimusops triflora Fr. Allem., Trab. Comm. Sc. Expl. Secção Bot. Rio de Janeiro 1:50, t. 13. 1866.

Mimusops Glaziovii Raunkiaer ex Warming, Vidensk. Meddel.

Naturh. Foren. 863, t. 1, fig. 1, 2. 1889.- pro parte,

Glaziovii 11157, fide Ducke (1950, p. 244).

Mimusops cearensis Huber, Bull. Herb. Boiss., ser. 2, 1:320. 1901.

Small tree, petioles 5 - 10 mm. long, blades small, 4 - 10 cm. long, 1.5 - 5.5 cm. broad, glabrous or midrib on underside sparsely brownish scurfy, lateral nerves not or hardly raised on underside, reticulation very faint under a lens. Pedicels few in each fascicle, 1 - 3 or rarely more, reflexed or spreading, surpassing subtending petiole, 1 - 1.5 cm. long, appressed-puberulent to almost glabrous in age, sepals 3 - 4.2 mm. long, fulvous squamulose, corolla-lobes 3 - 3.3 mm. long, pubescent, appendages shorter, staminodes deltoid, very short, much shorter than filaments, 0.3 - 0.9 mm. long, acute at apex, little if at all denticulate, filaments 1.5 - 1.7 mm. long, anthers 1.3 - 1.5 mm. long, ovary glabrous.

Type.- "habitat in arenosis prope mare," Ceará. "Typo de Freire Allemão no Museu Nacional" (Ducke 1918, p. 16). Syntypes of M. glaziovii; "Glaziov no. 11157 et 11158," Rio de Janeiro. (Photo of 11158 at Field Mus.). Type of M. cearensis: "hab. endroits bas entre Fortaleza et Bemfica, parmi les autres arbustes (26)," Ceará, Sept. and Oct. 1897.

Distrib.- Ceará, Piauí, Maranhão, Pará. Frequent in almost pure sand of dunes, in low plateaux and margins of marshy grounds the length of the Atlantic (Ducke 1950, p. 238). Cultivated at Museu Paraense (seed received from Piauí) and in Quinta de S. Cristovão, Rio de Janeiro.

Ducke (1950, p. 235, 238) credits Chevalier with transfer of the species to Manilkara: "Manilkara triflora (Fr. All.) Chev. = Mimusops cearensis Hub." I was unable to locate the combination in the works of Chevalier. The latter did not propose or submit the name to Ducke; the new combination in Ducke's revision was mentioned merely incidentally.

10. MANILKARA RUFULA (Miq.) H. Lam, Blumea 4:356. 1941.

Mimusops rufula Miq., in Mart. Fl. Bras. 7:44. 1856.

Very much like M. dardanoi, which is possibly a variety of this. See below for differences.

Type.- "Prov. Piauiensi: Gardner n. 2910. Fl. Hamadrayas." Isotype at Gray Herb.: "Pernambuco." Two photos and leaf fragment at Field Mus.

M. rufula in the sense of Ducke is M. bella.

11. MANILKARA DARDANOI Ducke, An. Bras. Econ. Florestal 3(3): 243. 1950.

Leaves crowded toward ends of branchlets, petioles 0.5 - 1 cm. long, blades coriaceous, obovate, 6 - 9 cm. long, 2.5 - 4 cm. broad, when young densely rufous-tomentose on underside with spreading crisped hairs (up to 0.2 mm. long), becoming glabrous except for some hairs occasionally persistent along midrib on upperside, midrib elevated or flattened on upperside, lateral nerves not raised. Pedicels surpassing subtending petiole, 1 - 1.3 cm. long, densely rufous-tomentose with spreading hairs, sepals 4.3 - 4.7 mm. long, corolla-segments 2.9 - 4.3 mm. long, staminodes broad, about equal to filaments in length, 1.3 - 1.7 mm. long, 2 - 3-plurifid at apex, base of staminodes and filaments united into a short tube (0.5 mm. high), filaments 1.2 - 1.8 mm. long, anthers 1 mm. long, ovary glabrous, 6-celled, fruit brilliant scarlet and somewhat fusiform.

Type.- "loco alto (Estrada da Aldeia) prope urbem Recife (Pernambuco), in relictis silvae, specimina florifera et sterile cum foliis novellis 24-VII-1950 legit Dárdano A. Lima (15.599)." Type tree was destroyed.

I have examined authenticated M. dardanoi, Ducke & Lima 8 and Ducke 8-X-1951 from Recife. The leaves differ from those of the Gray Herbarium isotype of M. rufula in the more rapid and complete loss of indumentum on the underside. Some hairs become grey and persist on the leaf undersurface of M. rufula isotype and the depressed reticulation of veinlets presents more of a blistered appearance to the leaf surface. The tomentum in M. dardanoi consists of slightly more spreading and crisped hairs; the pedicels are somewhat thicker. Corollas were lacking in the M. rufula examined. M. dardanoi and M. rufula are alike in their short petioles, the unraised lateral nerves, and in the character of indumentum on the sepals.

12. MANILKARA EXCELSA (Ducke) Standl., Trop. Woods 34:41. 1933.  
Mimusops excelsa Ducke, Arch. Jard. Bot. Rio de Janeiro  
 3:235. 1922.

Petioles 1.5 - 2 cm. long, tomentose, blades thin, elliptic, 10 cm. long, 2.5 - 3.5 cm. broad, usually acuminate at apex, matured leaves rufous-tomentose along midrib on underside, hairs spreading, crisped, grey-pilose along midrib on upperside, lateral nerves somewhat clear on underside, reticulation fine. Pedicels shorter than petiole, sepals 5 mm. long, rufous tomentose with spreading hairs, corolla-segments 3 mm. long, staminodes 1.8 mm. long, bifid to 0.8 mm., laciniae acute, staminodes and filaments united at base into tube 0.8 mm. long, filaments 1.3 mm. long, inflexed at tip, anthers 1.5 mm. long, ovary appressed pubescent.

Type.- "Frequentissima ad medium Tapajóz in silvis ripariis, specimina prope S. Luiz l. A. Ducke, florifera 26-8-1916 n. 16380, fructifera 8-12-1915 n. 15.863," Pará. Lectotype selected by me: Ducke 16380. Isotype at U.S.N.H. Ducke 15863 and 16380 "na beira da cachoeira Maranhãozinho" (Ducke 1950, p. 242).

Distrib.- Pará, middle course of Rio Tapajóz, chiefly along the cataracts in not too deeply flooded forests.

Leaf shape, tomentum and venation of M. excelsa somewhat recall M. zapotilla. Attains great size almost equal to that of M. huberi (Ducke 1950, p. 242).

13. MANILKARA PUBICARPA Monachino, sp. nov.

Arbor, petiolis 1.8 - 3.5 cm. longis, laminis glabris (7-)9 - 14.5 cm. longis, (3.5-)5 - 7 cm. latis, reticulo nervarum debili; pedicellis 2.5 - 2.7 cm. longis parce puberulis, sepalis 4 - 4.7 mm. longis extus rubiginoso-tomentosis, lobis perianthii ca. 4 mm. longis, filamentis 2 mm. longis, antheris 1.7 mm. longis, staminodiis filamentos paullo excedentibus, ad apicem bidentatis, ovario dense pubescenti.

Stem glabrescent, the young growth and buds rusty puberulent, petioles slightly puberulent, more densely so near base, blades chartaceous or at least relatively thin, paler beneath, oblong-elliptic, broadly cuneate at base, the apex a little narrowed, obtuse or acutish, sometimes slightly folded along midrib. Flowers white, 5 - 2 in each axil, pedicels spreading, straight or slightly curved, slender, gradually slightly broadened toward apex, ca. 0.7 mm. across at base, 1.3 mm. at apex, minutely sparsely puberulent, sepals reflexed or spreading at anthesis, ovate-oblong, or inner ones oblong, obtuse at apex, minutely rusty appressed tomentulose outside, slightly puberulent near margins within, corolla-tube ca. 0.7 mm. long, corolla-lobes ca. 3.5 mm. long, appendages 4.3 mm. long, staminodes 0.8 mm. broad, 2 mm. long, oblongish, sharply bidentate at apex, laciniae 0.5 - 0.8 mm. long, filaments ca. 2 mm. long, anthers 1.7 mm. long, ovary and base of style densely pubescent with appressed hairs, ovules 6.

Known only from Type.- Wilson-Browne 450 (Record No. 5860), British Guiana, Wabuwak, Kanuku Mts., 2000 feet, "Bastard Balata," tall tree of rain forest, white latex; deposited at The New York Botanical Garden.

Whereas the ovaries are pubescent in 12 out of the 13 spec-

ies (the exception is M. bidentata) of North America treated by Cronquist, those of the great majority of South America (exclusive of the Achras group) are glabrous.

14. MANILKARA LONGICILIATA Ducke (vel Mimusops longiciliata Ducke), Trop. Woods 71:22. 1942.

Manilkara longiciliata Ducke, An. Bras. Ec. Florestal 3(3):235, 239. 1950.

Petioles 1.5 - 3.5 cm. long, blades obovate, large, 7 - 14 cm. long, 4.5 - 8 cm. broad, underside with closely appressed furfuraceous indumentum overlaid with resin or appearing glabrous (close scurf on midrib), lateral nerves more or less raised on underside, reticulation not clear (in young leaves intricate and fine, veinlets slightly raised). Pedicels 2 cm. long, pale scurfy-tomentulose, sepals 5 - 5.7 mm. long, corolla-segments 4.5 mm. long, staminodes 3 mm. long, profoundly bilobed, tips thread-like, base of staminodes and filaments united into a short tube, filaments 2.2 mm. long, anthers 1.5 mm. long, ovary glabrous.

Type.- "Esperança ad ostium fluminis Javary in civitate Amazonas, loco alto in relictis silvae. Mense Februario 1942 fructificabat, Maio florebat. Ducke 941." Lectotype selected by me: Ducke 941, flowering specimen collected in May. Isotype at N.Y.B.G.

Distrib.- Brazil (Amazonas, Solimões and Rio Negro), terra firme.

15. MANILKARA INUNDATA (Ducke) Ducke, Trop. Woods 71:22. 1942. Mimusops inundata Ducke, Archiv. Inst. Biol. Veg. Rio de Janeiro 4:58. 1938.

Petioles 1.5 - 3.5 cm. long, blades thin, elliptic-oblong to oblanceolate, 7 - 16 cm. long, 2.5 - 5 cm. broad, glabrous, lateral nerves faint, reticulation obscure on the underside, fine and very slightly elevated under a lens. Pedicels 1.5 - 2 cm. long, loosely tomentulose, sepals 4.7 mm. long, tomentulose, corolla-segments 6 mm. long, staminodes 3.3 mm. long, profoundly bifid, tips thread-like, base of staminodes and filaments united in a tube 0.6 - 0.8 mm. long, filaments 1.8 mm. long, anthers 2 mm. long, ovary glabrous.

Type.- "Frequens in regione fluminis Madeira inferius prope Humaytá, silva periodice inundabili inter fluvium et lacum Paraíso, 26-6-1936, leg. A. Ducke, H.J.B.R. 34.979 et Ducke 216." Lectotype selected by me Ducke 216 (isotype at N.Y.B.G.)

Distrib.- Brazil (Amazonas, Matto Grosso, São Paulo de Olivença), Bolivia (flowering material, H.H.Rusby 729, Junction of Rivers Beni and Madre de Dios, Aug. 1886; cited as M. surinamensis by Britton in 1893, and annotated by Gilly in 1942 as a new species named in honor of Rusby), Peru (fruiting material, det. doubtful, Tessmann 5455a, Yarina Cocha; fr.-pedicels very long, up to 3.5 cm.), Colombia (specimens lacking corollas collected in 1945-6 by Schultes & Black in Amazonas appear to belong here). "Várzea forest, seldom in upland forest on moist and fertile clay loam" (Ducke).

As a footnote in the original description of Mimusops inundata in 1938, Ducke wrote: "ce nom devra être remplacé par Manilkara inundata Ducke, dans le cas où Manilkara sera maintenu comme genre." Some would hold this as nomen provisiorium.

16. MANILKARA SURINAMENSIS (Miq.) Dubard, Ann. Mus. Col. Mar-seille, ser. 3, 3:22. 1915.

Mimusops surinamensis Miq., in Mart. Fl. Bras. 7:43. 1863.

Mimusops amazonica Huber, Bol. Mus. Goeldi 4:433. 1904.

Mimusops Maparajuba Huber, op. cit. 434. - excl. seeds, fide Ducke (1950, p. 236).

Manilkara amazonica Chev., Rev. Ecol. appl. & Agr. Trop. 12:276. 1932; Standl., Trop. Woods 34:41. 1933.

Petioles 1.3 - 3 cm. long, blades 6 - 11.5 cm. long, 2.5 - 5.7 cm. broad, glabrous, lateral nerves raised on underside and reticulation minutely but clearly prominulous (in old coriaceous leaves character sometimes obscured by minutely bullate surface). Pedicels spreading, 12 mm. long, glabrous, flowers usually small, sepals 2.7 - 5.5 mm. long, the outer with a sparse minute appressed squamulae, corolla-tube 0.5 - 1 mm. long, segments 2.3 - 4.3 mm. long, staminodes 1 - 2.3 mm. long, lightly 2 - 3 dentate to deeply laciniate, filaments 1.5 - 2 mm. long, anthers 0.7 - 1.6 mm. long, ovary glabrous.

Type.- "Habitat ad flumina Cassiquiari, Vasiva et Pacimoni: Spruce n. 3351 et 3319. In terra Surinamensi: Hostmann n. 739 et 739a." Lectotype selected by me: Spruce 3351 (isotype at N.Y.B.G.). Type of M. amazonica: "temos especimens provenientes das matas da estrada de ferro de Bragança." Possibly J. Bouby 2572 (sterile specimen with young fruit, and photo at N.Y.B.G.). Ducke (1950, p. 236) wrote that the type is Herb. Mus. Pará 2527, not collected by Huber, with sparse flowers for past anthesis; in the hortus of Museu Paraense there are 4 trees left by Huber with the name M. amazonica, but only one belongs truly to this species, the three others representing M. siqueiraei. Ducke's citation of number 2527 may be an error for 2572. Type of M. maparajuba: "achei esta especie no rio Capim," Pará. Photo of Huber 855, Rio Capim, Acari-uçã, 27-VI-1897, "Maparajuba," at N.Y.B.G.

Distrib.- Brazil (Amazonas, Pará, Maranhão), Venezuela, probably Colombia. Exclusively on sandy soil, upland rain forests and in varzea forests; prefers terra firme, but occurs in inundated places; found along rivers with clear or "preta" (black) water, not in várzea inundated by muddy or "branca" (white) water; the most frequent species of the Amazon area (Ducke, reference to M. amazonica).

Eyma (1936, p. 208) wrote that Hostmann 739 in the Utrecht Herbarium has not a single corolla and the sheet of Hostmann 739a in Paris is not much better. These specimens are determined as M. bidentata by him. Ducke (1950, p. 240) rejected the Hostmann collections from M. surinamensis. A photo of 739a at Field Museum (ex Mus. Bot. Hauniense) looks like M. bidentata. The original description of M. surinamensis agrees with the Spruce plant.

A good example of variation in the staminodes of this species can be observed in Ducke 189 from Amazonas. The staminodes are either very shallowly dentate or deeply bifid. As many as 3 quite different staminodes can be found in the same flower. The same staminode was observed to have one of the two lobes 0.4 mm. and the other 2.0 mm. long.

Ducke examined a Spruce Cassiquiari isotype and knows typi-



cal *M. surinamensis* in the field. He is also intimate with typical *M. amazonica*.

He maintains the two species distinct; in his letter to me (Nov. 19, 1951), he wrote that *M. surinamensis*, certainly affinitive with *M. amazonica*, has usually larger leaves, more indumentum, and narrowly bifid staminodes. Ducke has seen hundreds of *M. amazonica* cut for chicle but never for balata.

17. *MANILKARA BIDENTATA* (A.DC.) Chev., Rev. Bot. & Agr. 12:270. 1932.

*Mimusops bidentata* A.DC., Prodr. 8:204. 1844.

Synonymy by Cronquist (1945, p. 553) includes the following: *M. sieberi*, *M. riedleana*, *M. nitida*, *M. dariensis*. *Mimusops balata* of Pierre and *Manilkara balata* of Dubard, and other authors, belong here. *Mimusops pierreana* Baillon (published as synonym of *M. balata*). *Sapota mulleri* Blume ex Bleekrod (Eyma: type, fruiting material, at Hb. Leiden. Chevalier. Engler. Pierre). *Achras balata* Aublet is the Old World *Mimusops commersonii* Engler, according to Chevalier (1922, p. 267); however, Pierre and Urban (1904, p. 165) stated that specimens of *Achras balata* Aublet in the Jussieu herbarium resemble exactly those of Richard's, type of *M. bidentata* A.DC.

Petioles 2 - 4.5 cm. long, blades large, 8 - 29 cm. long, 3.5 - 10 cm. broad, undersides scurfy, puberulent or apparently glabrous and vernicose (different varieties?) midrib on upper side raised or hardly so, lateral nerves raised on lower side, reticulation obscure or faintly prominulous (clear in young leaves). Pedicels shorter than or about equal to subtending petiole, slightly puberulent, sepals 5 mm. long, scurfy, corolla-segments 3.5 - 4.6 mm. long, staminodes very variable (different varieties?), shorter than filaments, 1 - 1.4 mm. long, apex acute, with 1 or 2 lateral teeth or irregularly cleft or dentate to different depths, filaments 2 mm. long, anthers 1.8 mm. long, ovary glabrous.

Type.- "in Guayana gallica...". in h. Deless. "Typifiée par un échantillon de Louis-Claude Richard récolte à la Guyane française en 1781" (Chevalier 1922, p. 270).

Illust.- Chevalier (1922, t. 8, photo "cotype de l'Herbier du Museum." T. 9, photo "No. 221. Jaune d'oeuf," with notes by Aublet; named *M. bidentata* var. *schomburgkii* by Pierre. P. 353, t. 10, A & B, micro. trans. & long. sect. wood). Engler (1904, p. 61, fig. 12, A-E, var. *muelleri*. F-N, var. *schomburgkii*). Engler (1891, as *M. balata* Gaertn., shows entire staminodes). Spoon (1927, fig. 1, "Bolletrie in oerwoud bij de Avanavero-vallen, Suriname," photo full length tree by A. Pulle. Fig. 2, photo trunk by G. Stahel. Fig. 3, anatomical. P. 4, 5 & 6, hab. & micro., as *M. globosa*.) Pfeiffer (1926, anatomical, as *M. surinamensis*).

Distrib.- West Indies (Cronquist), Guianas, Venezuela, Brazil (Amazonas, Pará). According to Ducke, in Brazil observed only on hill and mountain forests in extreme northeastern Amazonas and probably exists in the extreme north of Pará; mountains of Rio Branco. "Altos R. Erepecurú, Curúá, Maicurú e Parú" (P. Le Cointe, Arvores e Plantas Uteis, p. 49. 1934).

*M. bidentata* is a very important balata and timber tree. The literature concerning it is much greater than indicated

above. Taxonomic understanding regarding it, however, is in greater confusion than it is for any other species in the genus. At least 8 varieties have been proposed. *Eyma* prefers to exclude vars. *sieberi* and *melinonis* from *M. bidentata*.

Ducke (letter of Oct. 20, 1951) writes that a specimen of Ule's collection from Roraima, distributed as *M. bidentata* is certainly another species. Ducke (1938, p. 57) stated that Ule 8728, Rio Cuquenán, vic. Mt. Roraima, has very hard, absolutely glabrous leaves, tomentose flowers, sepals externally covered with a layer of glutinous resin. I have not seen Ule 8728. A collection from British Guiana (For. Dept. Brit. Gui. F. 2717, Record No. 5516, 90 mls. Bartica-Potaro Road, 25 Oct. 1947, Dicumbe-Eperua forest on white sand) is a strongly resiniferous form or variety of *M. bidentata*, with rigid glabrous leaves. The outer sepals appear glabrous, perhaps because of the close coating of resin. The staminodes are obovate, 2-4 short-toothed at each side of the terminal cusp. This tree is called "Black Balata" and said to have plentiful latex which does not coagulate. Tutin 202 from Surinam and Sagot 836 from French Guiana resemble it, and perhaps so does Hostmann 739a (photo at Field Mus.), which was cited by Miquel in the original description of *M. surinamensis*. Froes 1920 from Maranhão is somewhat intermediate between it and *M. siqueiraei*. "Black Balata" is applied to *M. huberi*, an altogether different species, while *M. bidentata* is called "true or commercial balata."

If the sort with coriaceous vernicose glabrous leaves represents a variety, its name must await study of the whole *M. bidentata* complex throughout its vast distribution. The type of *M. bidentata* was described as hairy: "foliis...subtus pilis minimis adpressis obscure velutinis." Ducke (letter of March 30, 1952) suggested that the *bidentata* complex be separated into two groups, "balata" trees and "chicle" trees. He does not suppose that the same species would yield both kinds of gum. He was informed at Manaus that the Venezuelan name "Pendare" used throughout the upper Rio Branco basin refers exclusively to chicle trees and never to balata trees. (However, Steyermark 60610, a sterile specimen from Ptaritepuí, Bolívar, Venezuela, is *M. bidentata*). I thought that a mass study of variation in a closed area such as Trinidad would add to clarifying the problem. R. S. Aylliffe, of the Forest Department in Trinidad, wrote (Feb. 21, 1952) that the study will not be an easy matter for "*Manilkara bidentata* is, of course, one of our first class trees. It is a very large tree and has been largely cut over in the past for its durable wood, so that it is scarce now."

H. W. Youngken examined microscopically very small leaf sections of *M. bidentata*, Fanshawe 200, F.C. Foote s.n., B.W. 4152, Schomburgk 780. He reported (letters of Feb. 14 & 27, 1952) that the so-called pubescence is an illusory one; it is largely due to waxy cuticular scales, granulations and low cuticular emergences.

17a. *MANILKARA SIQUEIRAEI* Ducke (vel *Mimusops siqueiraei* Ducke), Trop. Woods 71:24. 1942.

Flowers (Ducke 1241, Froes 20344) larger than those of *M. bidentata*; staminodes irregularly dentate. Leaves resemble those of the glabrous forms of *M. bidentata*; sepals 6 - 7 mm.

long, corolla-segments 5.3 - 5.7 mm. long, staminodes 1.8 - 2 mm. long, slightly shorter than filaments.

Type.- "specimina florifera lecta ad flumen Magoary prope Belém, 15-6-1942, D. 945."

Distrib.- Pará, Maranhão. Huber left 3 trees cultivated in Horto do Museu Paraense (Ducke, 1950, p. 235, 236).

Ducke (Jan. 1, 1952) wrote that M. bidentata, which yields the balata of superior quality, has except in very old age a tenuous sericeous indumentum on the lower surface of the leaves, never observed in M. siqueiraei. And again (letter of May 29, 1952) that the balata-yielding Manilkara of the Guianas and the Brazilian boundary is certainly a species independent from M. siqueiraei. All balateiros say it can be recognized by the pale, a bit silky, undersurface of the leaves. Ducke argues that M. bidentata grows exclusively on hills and mountains, according to all balateiros. M. siqueiraei (Ducke, 1950, p. 239) is found in Igapó, along rivers inundated by sometimes brackish water. It is different from the bidentata complex (letter Nov. 19, 1951) by its habitat in swamp land chiefly with brackish water in eastern Pará. The latex is not exploited for balata or chicle.

Very small leaf-sections of Ducke 1241, typical M. siqueiraei from Belém, and Maguire & Fanshawe 23506, a glabrous form of M. bidentata from British Guiana, were sent to Youngken for histological study. Dr. Youngken examined these tiny segments microscopically in surface and transverse sections and reported (Feb. 14, 1952): "There is no real significant difference histologically...I found no real difference between the stomatal apparatus."

M. siqueiraei belongs in, or in the neighborhood of, the M. bidentata complex; it is not placed in the synonymy of the latter on the authority of Ducke.

18. MANILKARA WILLIAMSII Standl., Field Mus. Pub. Bot. 22(3): 165. 1940.

Tree 20 - 30 meters or taller, petioles 2 - 3.5 cm. long, black, blades coriaceous, obovate, 8 - 12 cm. long, 4.5 - 7 cm. broad, rounded-emarginate at apex, markedly and sharply cuneate toward base, minutely puberulent beneath with very short appressed hairs, lateral nerves raised on underside, reticulation obscure. Flowers in bud only. Ovary glabrous, about 10-celled.

Type.- "Venezuela: Guayapo, Bajo Caura, Estado de Bolivar, alt. 100 meters, April 18, 1939, Llewelyn Williams 11860 (type in Herb. Field Mus.)." Isotype at N.Y.B.G.

Tree found in low ground that is not very wet, and also in high forests that are not flooded. Said to grow in abundance in the mountains of Nichare, Icuta, Tres Picos, below Salto de Para, and in the vicinity of Caño de Pablo and Erebató, above Salto. Latex abundant, sticky, the balata of commerce. Fruit has an edible pulp. Local name "purguo."

Except for the very striking cuneate leaf-base, this species has wholly the aspect of forms of M. bidentata. Its specific distinction from M. bidentata remains to be proven.

19. MANILKARA sp. indet. (Horto Rio de Janeiro culta).

Branchlets robust, grey, covered with minute appressed resinous squamulae, leaves with aspect of those of M. longifolia except for indumentum, petioles 2.5 - 3.5 cm. long, minutely squamulose like the branchlets, blades coriaceous, 15 - 26 cm. long, 5 - 9 cm. broad, greatly tapering at base, rounded-emarginate and slightly conduplicate at apex, underside closely invested with minute appressed resinous flakes, or subpulverulent gummy, lateral nerves faint. Pedicels reflexed or spreading, brown, 2.5 cm. long, viscid appressed puberulent, calyx 4.8 - 5 mm. across, sepals 5.3 mm. long, scurfy, acutish at apex, corolla-tube 2 mm. long, segments 4.8 - 5.5 mm. long, appendages shorter than lobes, acute, staminodes carnosae, peg-like, much shorter than filaments, 0.7 mm. long, entire or shallowly bidentate, filaments 2.2 - 2.7 mm. long, anthers 3.3 mm. long, ovary glabrous, cells 10 - 12.

A. Ducke 2406, Horto Bot. Rio de Janeiro culta, X-1928, arbor parva flor. albidis, "Mimusops balata Gaertn." (U.S.N.H.; frag. at N.Y.B.G.). Also examined H.M. Curran 327, Bot. Gd., Rio de Janeiro, Nov. 1915, 30 ft. x 12 in., "Mimusops balata" (U.S.N.H.; frag. at N.Y.B.G.).

This is nearest M. bidentata, of the known American species. I have not succeeded in identifying it with any of the Old World Sapotaceae. Ducke (letter of March 30, 1952) informed me that it seems to have been introduced by Barbosa Rodrigues from some botanical garden. Ducke has sent material to Sandwith and Eyma, but has not yet received an answer.

Barbosa Rodrigues (1893) listed the cultivation of "Mimusops balata Gaertn."

Material of South American Manilkara was borrowed from various institutions in the hope of discovering a collection of this species from wild plants, perhaps confused with M. longifolia. I shall leave the plant unnamed until its nativity is known.

20. MANILKARA CALYCICOLA var. COLOMBIANA Gilly, Trop. Woods 73:17. 1943. - Placed in synonymy of M. chicle (Pitt.) Gilly by Cronquist (1945, p. 561).

Petioles 2 - 3.5 cm. long, subscurfy, blades (12-)14 - 18(-20) cm. long, 4.5 - 9 cm. broad, subvernicoose beneath, glabrous at maturity or the scurfy indumentum vaguely detectable beneath the resin, lateral nerves somewhat raised on underside, reticulation not marked. Pedicels ca. 4 in each axil, 2 cm. long, sepals 7 - 8 mm. long, greyish-tomentose outside, corolla-tube 2 - 2.4 mm. long, lobes 5 - 6 mm. long, elliptic, entire, staminodes 2.8 - 4 mm. long, acute, irregularly erose or lacinate, filaments 2.7 mm. long, anthers of about equal length, ovary appressed tomentose.

Type.- "Colombia: Dept. Choco: Darien Country, Dawe 868 (N.Y. - type, U.S.)." Type of M. chicle: Pittier 8537, Guatemala, Izabel.

21. MANILKARA MERIDIONALIS Gilly, Trop. Woods 73:12. 1943.

M. meridionalis var. caribbensis Gilly, op. cit. 13. - syn. fide Cronquist (1945, p. 560. Also M. tabogaensis Gilly and M. rojasii Gilly).

Similar to M. zapotilla. Appendages and lobes about 4 mm. long, united  $1\frac{1}{3}$  -  $2\frac{2}{3}$  their length, staminodes 2.5 - 6 mm. long.

Type.- "Costa Rica: Punta Arenas: Esparta, Feb. 1909, Biolley 17308 (NY photo & frag., US-Type)." Type of var. caribbensis: "Venezuela: Isle Margarita, El Valle, July 1901, Miller & Johnston 103 (Gray-Type, NY photo)."

Distrib.- Mexico to Colombia and Venezuela, introduced (?) in West Indies (Cronquist).

22. MANILKARA ZAPOTILLA (Jacq.) Gilly, Trop. Woods 73:20. 1943.

Achras zapota  $\beta$  zapotilla Jacq., Stirp. Amer. 57, t. 41. 1763.

Sapota Achras Miller, Gard. Dict., ed. 8. 1768.

Achras zapotilla Nutt., N. Am. Sylv. 3:28. 1849.

"Achras zapota L." of authors, not L. 1753.

For further synonymy see Gilly (1943, p. 20). Cronquist adds to the synonymy the following 4 Gilly species of Manilkara: calderonii, conzatii, gaumeri, breviloba.

Petioles 1.5 - 2.5 cm. long, blades 5 - 15 cm. long, 2 - 5 cm. broad, densely rufous-tomentose with spreading hairs when young, at maturity glabrous or tomentum remaining at base of petiole, sometimes also on midrib on underside, lateral nerves not prominent, reticulation minutely prominulous under lens. Pedicel solitary in the axil, 1.5 cm. long, rufous-tomentose with spreading hairs, sepals likewise woolly, 7 - 9 mm. long, corolla-tube and lobes about equal in length, appendages connate with the lobe forming single segments, entire or variously and irregularly denticulate at apex, staminodes about length of corolla-lobes, filaments inserted slightly below orifice of corolla-tube, 1.3 mm. long, anther 2 mm. long, ovary tomentose.

Type.- "Brown, jam. 2, p. 200: Sloan. hist. jam. 2, p. 171, t. 230; Plum. gen. 43, sapota fructu turbinato minori." "Description and figure in Browne's Civil and Natural History of Jamaica, p. 200, pl. 19" (Cronquist). Browne's description was under Achras I, The Sapodilla Tree; his illustration, fig. 3 of t. 19.

Illust.- There are a great many illustrations of this economically important tree. Curtis (Bot. Mag. 58, t. 3111, 3112. 1831). Descourtilz (Fl. Pitt. & Med. Antilles 4, t. 259. 1827). Roques (Pl. Usuell. Indig. & Exot. 2, t. 32. 1802). Engler (1891, fig. 72, 73). Miquel (1856, t. 22, 23). L. H. Bailey's Revised Ed. of Manual of Cultivated Plants (1949), p. 790, fig. 162, Aa, fruiting branch, is M. zapotilla, not Calocarpum sapota, as named.

Distrib.- Central America, Mexico, West Indies, Florida. Cultivated in all warm countries and sometimes escaped. South America: Colombia (Bolívar, vic. Turbaco, clearing, Killip & Smith 14484). Vallée du Magdalena & Mariquita, Triana 2605). Brazil (Ceará, Fortaleza, open woods, Drouet 2552).

Achras ferruginea Casar. and A. tchicomame Perr., referred to A. sapota by Index Kewensis, are not of Manilkara.

The literature on the plant is very extensive. If the taxon is a species-complex in the sense of Gilly there is little precision regarding the species treated.



## SUMMARY

In the present revision of the South American species of Manilkara 3 new species are proposed: M. pubicarpa is based on a new collection from British Guiana, whereas M. bella and M. duckei are based on new interpretation of old collections from southern Brazil. M. elata is identified with M. huberi as a result of study of type material. The species treated number 23: 20 are of Eumanilkara (3 being doubtfully distinct) and 3 are of Achras. One of the Eumanilkara, cultivated at Rio de Janeiro, is described, but not named. A key, descriptions, synonymy, and references to literature are presented.

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